Abstract

The various changes of the global climatic condition have raised the demand of using Renewable Energy Sources (RES) in respect of the changes regarding control and efficiency of the existing utilities. Consequently, the introduction of distributed generation has opened the doors of new concepts of electrical energy transfer, such as microgrids. The power systems scenario is experiencing a revolution in terms of operational flexibility, which is led by the interest of distribution system operators to reduce losses in order to reduce operational fixed costs.

As a result, power grids are becoming more and more capillary due to the penetration of distributed generation and new control strategies are therefore necessary in order to provide efficient energy distribution, leading to the exploration of power distribution in a DC microgrid pattern. Although DC power distribution has been equipped in islanded systems as aircraft, ships, and communication centers, the technology is rather young and must be examined with respect to technical practicability when applied to already existing distribution systems. Microgrids, as a promising building block of future smart distribution systems, are one of the main areas where the DC technologies are expected to prevail. Hybrid AC/DC Microgrids may facilitate the integration process of DC power technologies into the existing AC systems.

This thesis investigates about the integration of an algorithm of network reconfiguration for minimum power loss in hybrid AC/DC grid with real time validation. A generalized algorithm is developed to find the hybrid AC/DC power flow of a distribution network, which was modeled with RTDS. The results are compared and validated thanks to real time simulations, that leads to the best grid configuration according to the load profile, proving the benefits of medium voltage hybrid AC/DC grid systems.

Keywords: Smart Grids, Real Time, Hybrid AC/DC grid, Power Grid, Power Flow, Minimum loss